WHAT IS CLAIMED IS:

1. A system for detecting and correcting non-stationary noise present on an input data signal comprising:

a detector module based on Gram Schmidt orthogonalization, receiving the input data signal and producing as output a correction enable signal indicating when a correction is required;

a corrector module receiving the input data signal and correction enable signal and producing a corrected data signal as output; and

a reliability estimator and selector module receiving the corrected data signal and the input data signal and producing an output signal which is the more reliable of the input data signal and the corrected data signal.

2. The system of claim 1, wherein the reliability estimator and selector module comprises:

a first reliability estimator receiving the corrected data signal and producing as output a first reliability estimate indicating the reliability of the corrected data signal;

a second reliability estimator receiving the input data signal and producing as output a second reliability estimate indicating the reliability of the input data signal; and

a comparison module receiving the first and second reliability estimates and selecting one of the corrected data signal and the input data signal as output depending on relative values of the first and second reliability estimates.

3. The system of claim 2, wherein the comparison module is configured to select a default output signal when the input data signal and the corrected data signal have reliabilities which are less than a predetermined reliability threshold.

4. The system of claim 3, wherein the default output signal comprises an erasure.

5. The system of claim 2, wherein:

the first and second reliability estimators each comprise a slicer; and

the first and second reliability estimates each comprise a reliability metric indicating a difference

between the input to the respective slicer and the output from the respective slicer, wherein the lower the reliability metric, the more reliable the signal.

6. The system of claim 5, wherein the comparison module is configured to select a default output signal when the first and second reliability estimates each exceed a predetermined threshold.

7. The system of claim 1, wherein the non-stationary noise is an impulse noise and wherein the detector module includes an impulse detector module which comprises:

a first impulse detector receiving the input data signal and producing a first impulse detection signal as output;

a second impulse detector receiving the input data signal and producing a second impulse detection signal as output; and

an impulse correction enable module receiving the first and second impulse detection signals and producing the correction enable signal in accordance with the first and second impulse detection signals.

8. The system of claim 1, wherein the non-stationary noise is an impulse noise and wherein the corrector module includes an impulse corrector module which comprises an impulse blanker module and an impulse canceler module, the blanker or canceler modules being selected in accordance with the correction enable signal produced by the impulse corrector module.

9. The system of claim 7, wherein the first and second impulse detectors are complementary.

10. The system of claim 9, wherein:

the first impulse detector comprises a Gram Schmidt impulse detector; and

the second impulse detector comprises a moving window threshold detector.

11. The system of claim 10, wherein the impulse corrector module comprises an impulse blanker module and an impulse canceler module, the blanker or canceler modules being selected in accordance with the correction enable signal produced by the impulse corrector module.

12. The system of claim 11, wherein the impulse correction enable module is configured to generate the correction enable signal to:

blank an impulse if an impulse is detected by the moving window threshold detector but not the Gram Schmidt impulse detector;

cancel an impulse if an impulse is detected using the Gram Schmidt impulse detector but not the moving window threshold detector;

cancel an impulse if an impulse is detected by the Gram Schmidt impulse detector at a first time of arrival, and an impulse is detected by the moving window threshold detector at a second time of arrival within a predetermined interval from the first time of arrival; and

blank an impulse if an impulse is detected by the Gram Schmidt impulse detector at a first time of arrival, and an impulse is detected by the moving window threshold detector at a second time of arrival which is not within a predetermined interval from the first time of arrival.

13. The system of claim 8, wherein the detector module generates an impulse location signal which is provided to the impulse canceler module which in turn generates as output a waveform estimate of a detected impulse which is used to cancel the detected impulse.

14. The system of claim 13, wherein the impulse canceler module comprises an iterative decision feedback impulse canceler.

15. The system of claim 13, wherein the impulse canceler module comprises a least square impulse canceler.

16. A system for detecting impulse noise in a multi-channel data signal having at least one quiet channel, the quiet channel having substantially less modulated power than remaining channels, the system comprising:

a whitener having a transfer function which equalizes average noise in the input signal and which receives the data signal and produces a whitened signal;

a whitener match filter having a frequency response which is a complex conjugate of the whitener transfer function, the match filter receiving the whitened signal and producing a match filter signal; and

an impulse detector which receives the match filter signal and produces a detected impulse location signal indicating the time of arrival of detected impulses.

17. The system of claim 16, wherein the whitener and whitener match filter are combined in a single filter element.

18. The system of claim 16, wherein the impulse detector comprises a Gram Schmidt impulse detector.

19. The system of claim 18, wherein the Gram Schmidt impulse detector comprises:

a FIFO module of a predetermined length L receiving the match filter signal and producing a first column vector of height L as output;

a Gram Schmidt multiplication module receiving the first column vector as input and producing a second column vector of height L as output, the second column vector comprising a matrix product of the first column vector and an L*L Gram Schmidt matrix,

wherein each component of the second column vector represents a projection of a detected impulse on one of a Gram Schmidt orthogonal basis vectors; and

an energy summation module receiving the second column vector and producing an energy output which is a combination of the elements in the second column vector, the value of the energy output indicating an overall energy of elements in the first column vector;

wherein an impulse detection occurs when the energy output exceeds a predetermined energy threshold.

20. The system of claim 19, further comprising a multiple detection suppression module receiving the energy output and configured to select a most likely impulse detection from a plurality of detections occurring within a predetermined time interval.

21. The system of claim 20, wherein the multiple detection suppression module is configured to select the most likely impulse detection according to a regional maximization function.

22. The system of claim 20, wherein the multiple detection suppression module comprises:

a group divider module receiving the energy output from the energy summation module and configured to divide the received energy output into a plurality of groups, identify a maximum energy point in each group, and indicate the identified maximum energy points as output;

a local maxima detector which receives the identified maximum energy point indications from the group divider module and which provides an indication of a local maxima amongst the plurality of groups as output; and

a threshold local maxima module which receives the indication of a local maxima from the local maxima detector and which indicates that an impulse is present when the local maxima is higher than the predetermined energy threshold, a time of arrival for the detected

impulse being a time corresponding to the time of the maximum sample in the group containing the local maxima.

23. The system of claim 13, further comprising a merge module which receives the impulse location signal from the detector module and also receives at least one additional impulse location signal from an impulse detector associated with a neighboring band and which produces as output a combined estimated impulse timing.

24. The system of claim 1, wherein the non-stationary noise comprises low dimensionality noise contained in at most a few dimensions.

25. The system of claim 24, wherein the low dimensionality noise comprises fast popping ingresses.

26. The system of claim 1, wherein the data signal is carried on one of a single carrier modem, a multitone modem, and a CDMA modem.

27. A sytem for detecting low dimensionality noise in a data signal, comprising:

a detector module based on Gram Schmidt orthogonalization, receiving the input data signal and producing as output a noise detection signal.

28. The system of claim 27, further comprising:

a filter module receiving the data signal and producing a match filter signal;

a FIFO module of a predetermined length L receiving the match filter signal and producing a first column vector of height L as output;

a Gram Schmidt multiplication module receiving the first column vector as input and producing a second column vector of height L as output, the second column vector comprising a matrix product of the first column vector and an L*L Gram Schmidt matrix, wherein each component of the second column vector represents a projection of detected low dimensionality noise on one of a Gram Schmidt orthogonal basis vectors; and

an energy summation module receiving the second column vector and producing a energy output which is a combination of the elements in the second column vector, the value of the energy output indicating an overall energy of elements in the first column vector;

wherein a low dimensionality noise detection occurs when the energy output exceeds a predetermined energy threshold.

29. A method for detecting and correcting non-stationary noise present on an input data signal comprising:

receiving the input data signal at a detector module based on Gram Schmidt orthogonalization which produces as output a correction enable signal indicating when a correction is required;

receiving the input data signal and correction enable signal at a corrector module which produces a corrected data signal as output; and

receiving the corrected data signal and the input data signal at a reliability estimator and selector module which produces an output signal which is the more reliable of the input data signal and the corrected data signal.

30. The method of claim 29, further comprising the following steps:

receiving the corrected data signal at a first reliability estimator which produces as output a first reliability estimate indicating the reliability of the corrected data signal;

receiving the input data signal at a second reliability estimator which produces as output a second reliability estimate indicating the reliability of the input data signal; and

comparing the first and second reliability estimates using a comparison module which selects one of the corrected data signal and the input data signal as output depending on relative values of the first and second reliability estimates.

31. The method of claim 30, wherein the comparison module performs the step of selecting a default output signal when the input data signal and the corrected data signal have reliabilities which are less than a predetermined reliability threshold.

32. The method of claim 31, wherein the default output signal comprises an erasure.

33. The method of claim 30, further comprising the following steps:

utilizing a slicer in each of the first and second reliability estimators; and

the first and second reliability estimates each comprising a reliability metric indicating a difference between the input to the respective slicer and the output from the respective slicer, wherein the lower the reliability metric, the more reliable the signal.

34. The method of claim 33, wherein the comparison module performs the step of selecting a default output signal when the first and second reliability estimates each exceed a predetermined threshold.

35. The method of claim 29, wherein the non-stationary noise is an impulse noise and wherein the detector module includes an impulse detector module, the method further comprising the following steps:

receiving the input data signal at a first impulse detector which produces a first impulse detection signal as output;

receiving the input data signal at a second impulse detector which produces a second impulse detection signal as output; and

receiving the first and second impulse detection signals at an impulse correction enable module which produces the correction enable signal in accordance with the first and second impulse detection signals.

36. The method of claim 29, wherein the non-stationary noise is an impulse noise and wherein the corrector module includes an impulse corrector module which comprises an impulse blanker module and an impulse canceler module, the method further comprising the step of selecting the blanker or canceler modules in accordance with the correction enable signal produced by the impulse corrector module.

37. The method of claim 35, wherein the first and second impulse detectors are complementary.

38. The method of claim 37, wherein:

the first impulse detector comprises a Gram Schmidt impulse detector; and

the second impulse detector comprises a moving window threshold detector.

39. The method of claim 38, wherein the impulse corrector module comprises an impulse blanker module and an impulse canceler module, the method further comprising the step of selecting one of the blanker or canceler modules in accordance with the correction enable signal produced by the impulse corrector module.

40. The method of claim 39, further comprising the step of utilizing the impulse correction enable module to generate the correction enable signal to:

blank an impulse if an impulse is detected by the moving window threshold detector but not the Gram Schmidt impulse detector;

cancel an impulse if an impulse is detected using the Gram Schmidt impulse detector but not the moving window threshold detector;

cancel an impulse if an impulse is detected by the Gram Schmidt impulse detector at a first time of arrival, and an impulse is detected by the moving window threshold detector at a second time of arrival within a predetermined interval from the first time of arrival; and

blank an impulse if an impulse is detected by the Gram Schmidt impulse detector at a first time of arrival, and an impulse is detected by the moving window threshold detector at a second time of arrival which is not within a predetermined interval from the first time of arrival.

41. The method of claim 36, wherein the detector module performs the step of generating an impulse location signal which is provided to the impulse canceler module which in turn generates as output a waveform estimate of a detected impulse which is used to cancel the detected impulse.

42. The method of claim 41, wherein the impulse canceler module comprises an iterative decision feedback impulse canceler.

43. The method of claim 41, wherein the impulse canceler module comprises a least square impulse canceler.

44. A method for detecting impulse noise in a multi-channel data signal having at least one quiet channel, the quiet channel having substantially less modulated power than remaining channels, the method comprising the following steps:

equalizing the average noise in the input signal using a whitener having a transfer function which equalizes the average noise in the input signal and which receives the data signal and produces a whitened signal;

utilizing a whitener match filter having a frequency response which is a complex conjugate of the whitener transfer function, the match filter receiving the whitened signal and producing a match filter signal; and

receiving the match filter signal at an impulse detector which produces a detected impulse location signal indicating the time of arrival of detected impulses.

45. The method of claim 44, wherein the whitener and whitener match filter are combined in a single filter element.

46. The method of claim 44, wherein the impulse detector comprises a Gram Schmidt impulse detector.

47. The method of claim 44, further comprising the following steps performed by the Gram Schmidt impulse detector:

receiving the matched filter signal at a FIFO module of a predetermined length L which produces a first column vector of height L as output;

utilizing a Gram Schmidt multiplication module to receive the first column vector as input and produce a second column vector of height L as output, the second column vector comprising a matrix product of the first column vector and an L*L Gram Schmidt matrix, wherein each component of the second column vector represents a projection of a detected impulse on one of a Gram Schmidt orthogonal basis vectors; and

receiving the second column vector at an energy summation module which produces an energy output which is a combination of the elements in the second column vector, the value of the energy output indicating an overall energy of elements in the first column vector;

wherein an impulse detection occurs when the energy output exceeds a predetermined energy threshold.

48. The method of claim 47, further comprising the step of receiving the energy output at a multiple detection suppression module which selects a most likely impulse detection from a plurality of detections occurring within a predetermined time interval.

49. The method of claim 48, further comprising the step of selecting the most likely impulse detection according to a regional maximization function.

50. The method of claim 48, further comprising the following steps performed by the multiple detection suppression module:

Receiving the energy output from the energy summation module at a group divider module and dividing the receved energy output into a plurality of groups identifying a maximum energy point in eash group, and indicating the identified maximyum energy points as output;

Receiving the identified maximum energy point indications at a local maxima detector and providing an indicaiton of a local maxima amongst the plurality of groups as output; and

Receiving the indication of a local maxima at a thresold local maxima module which indicates that an impulse is present when the local maxima is higher than the

predetermined energy threshold, a time of arrival for the detected impulse being a time corresponding to the time of the maximum sample in the group containing the local maxima.

51. The method of claim 41, further comprising the step of receiving at a merge module the impulse location signal from the detector module and also receiving at least one additional impulse location signal from an impulse detector associated with a neighboring band and producing as output a combined estimated impulse timing

52. The method of claim 29, wherein the non-stationary noise comprises low dimensionality noise contained in at most a few dimensions.

53. The method of claim 52, wherein the low dimensionality noise comprises fast popping ingresses.

54. The method of claim 29, wherein the data signal is carried on one of a single carrier modem, a multitone modem, and a CDMA modem.

55. A method for detecting low dimensionality noise in a data signal, comprising:

receiving the input data signal at a detector module based on Gram Schmidt orthogonalization which produces as output a noise detection signal.

56. The method of claim 55, further comprising the following steps:

receiving the data signal at a filter module which produces a match filter signal;

receiving the match filter signal at a FIFO module of a predetermined length L which produces a first column vector of height L as output;

utilizing a Gram Schmidt multiplication module to receive the first column vector as input and produce a second column vector of height L as output, the second column vector comprising a matrix product of the first column vector and an L*L Gram Schmidt matrix, wherein each component of the second column vector represents a projection of detected low dimensionality noise on one of a Gram Schmidt orthogonal basis vectors; and

utilizing an energy summation module to receive the second column vector and produce an energy output which is a combination of the elements in the second column vector, the value of the energy output indicating an overall energy of elements in the first column vector;

wherein a low dimensionality noise detection occurs when the energy output exceeds a predetermined energy threshold.

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